

Idle Reduction Options for Locomotives

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What are locomotive idling impacts?

Approximately 5,000 switchers nationwide
Idling 2,500 – 3,000 hrs/year

Per Switcher	CO ₂ (g/hr)	NO _x (g/hr)	PM (g/hr)	FC (gal/hr)
Range		800-1000	26 - 32	4.5-5.0
Industry tons/yr	800,000 tpy	17,000 tpy	500 tpy	67.5 million gal

Other impacts

- Reduction in air toxics
- Reduction of pollutants in environmental justice areas
- Reduction of noise pollution
- Decreased maintenance on engines
- Increased engine life

Locomotive Idling Time

	<u>Road Idle Time</u>	<u>Yard Idle Time</u>
EPA Estimate	38.0%	59.8%
AAR Estimate	54.0%	75.4%
RAC Estimate	60.0%	81.0%

EPA = Environmental Protection Agency
AAR = American Association of Railroads
RAC = Railway Association of Canada

Fuel Consumption

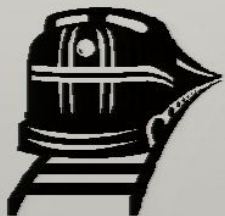
Locomotive switcher consumes:

3 - 4 gal/hr @ notch 1

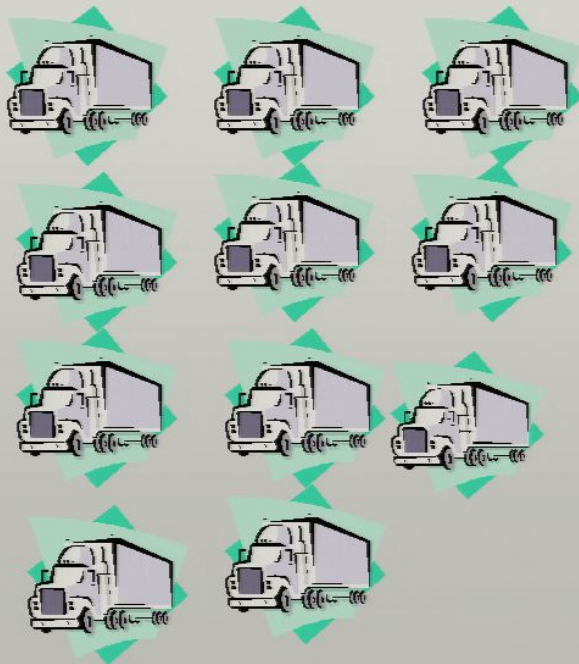
8 – 11 gas/hr @ notch 3

A locomotive typically idles at the “idle” throttle setting, but when outside temperatures drop to 10-15F, the locomotive is idled at the “notch 3” setting to keep the engine warm.

21,685 gallons/year!

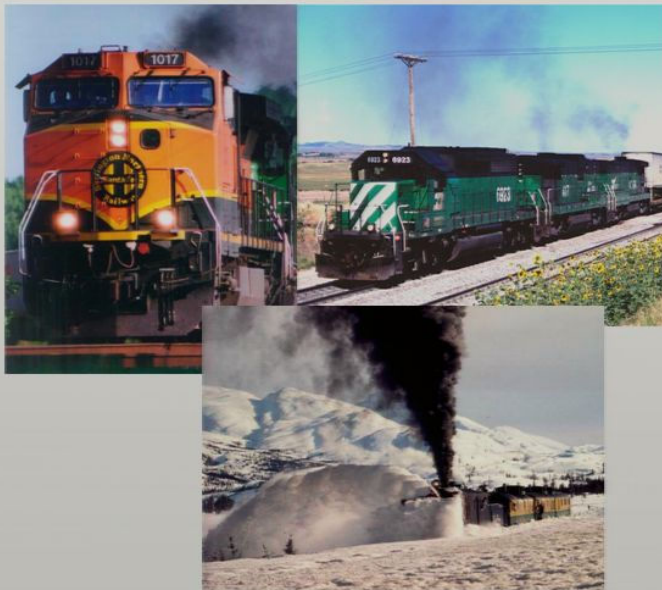


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In a typical year, one locomotive consumes as much fuel idling as 11 idling semi-trucks (assumptions per EPA420-R-02-025).

Fuel In = Emissions Out



Why do locomotives idle?

- Protect engine in cold weather
- Avoid difficult start-ups
- Maintain batteries charged
- Cab comfort
- Habit

Note: Locomotive engine is 30 times bigger than engine in Suburban, does not use anti-freeze, uses a 74vDC starter motor and runs on diesel fuel.

Locomotive Idling Reduction Options

- Automatic Shut-Down/Start Up System
- Auxiliary Power Unit (APU)
- Diesel Driven Heating System (DDHS)
- Shore Power Plug-in Unit
- Hybrid Switching Locomotive
- Genset Switching Locomotive

Locomotive Auto Shut-Down/Start-Up Systems

- **What is it?**

- Microprocessor technology that automatically manages the shutdown and restart of locomotives while parked idling. Continuous monitors conditions against preprogrammed values

- **Cost:** \$7,500

- **Issues:**

- Can be combined with DDHS for cold weather applications

- **Major Manufacturer:** ZTR Control Systems



Locomotive Auxiliary Power Unit

- **What is it?**
 - APA allows idling locomotive to be shutdown by heating coolant and oil, charging batteries, powering cab heaters
 - Enables 60 Hz power
- **Cost:** \$30,000 - \$40,000
- **Issues:**
 - Most useful on switcher locomotives

- **Major Manufacturer:** Eco Trans, Thermo King



Locomotive Diesel Driven Heating System

- **What is it?**

- System allows idling locomotive to be shutdown by heating and circulating the coolant and oil, charging batteries, powering cab heaters
- Variable engine speed generates optimum waste heat

- **Cost:** \$27,000 - \$29,000

- **Issues:**

- Most useful on switcher locomotives
- No 60 Hz power

- **Major Manufacturer:** Kim Hotstart



Hybrid Switcher Locomotive

- What is it?
 - switchers have small diesel gensets, large banks of long-life, recyclable batteries, and do not idle.
 - The small diesel generator only operates when the batteries need to be recharged to their optimum levels. Batteries power traction motors
- **Cost:** \$750K – \$925K using old locomotive frame
- **Issues:**
 - Limited to yard switcher applications

- Major Manufacturer:
RailPower



Shore Power Plug-in System

- **What is it?**

- System allows idling locomotive to be shutdown by using shore power to heat and circulate coolant and oil, optional battery charger

- **Cost:** \$4,000 - \$12,000

- **Issues:**

- Most useful on commuter trains
- Locomotive must be near external power source to shutdown

- **Major Manufacturer:** Kim Hotstart



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- Major Manufacturer:
RailPower



Genset Diesel Switcher

- **What is it?**
 - Uses 2-3 700hp diesel gensets
 - Depending on the power requirements of the application, the unit will either run on battery alone (for the hybrid model), one engine, or any combination of battery and engines).
- **Cost:** \$960,000 using old locomotive frame
- **Issues:**
 - Can be used for Yard and Road switcher applications
 - Can be shut down up to 20F

- **Major Manufacturer:**
RailPower, National Railway Equipment



EPA Project

- 1st project to test a locomotive idle reduction technology.
- Driven by idle reduction directive in the National Energy Policy.
- Goal = Quantify reductions in fuel consumption, emissions and noise.

EPA Project Partners

Funding & resources supplied by;

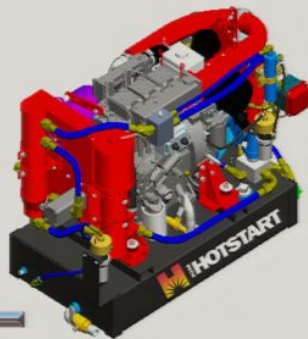
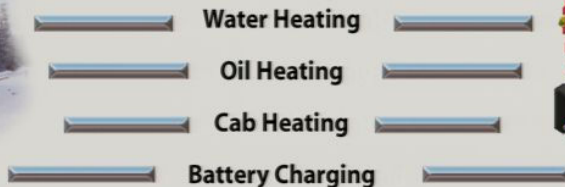
- EPA
- City of Chicago, Dept of Environment
- BNSF Railroad
- Wisconsin & Southern Railroad
- Kim Hotstart Manufacturing Company



BNSF



Technology



The “Hotstart” Diesel Driven Heating System manufactured by Kim Hotstart Manufacturing company of Spokane, WA was selected for the project. The Hotstart allows an idling locomotive to be shutdown by keeping the locomotive engine temperature above 100F and keeping the batteries charged.

7 Retrofits

- 3 Hotstarts installed on BNSF GP 38 locomotives idling in Corwith Yard
 - BNSF 2133 also equipped with SmartStart system (ZRT Control Systems) to automatically shutdown locomotive.
- 4 Hotstarts installed on WS SD 40-2 locomotives idling in Belt Railway

BNSF GP38 Locomotive

Engine = 16-645E (10,320 CID, 2000hp)



WSOR SD40-2 Locomotive

Engine = 16-645E3 (10,320 CID, 3000hp)



Retrofits



BNSF 2133 Results

- Idle Time Reduced 80%
- Fuel Savings per day = 42.7 gallons
- Fuel Savings per year = 14,339 gallons
- NOx reduced per year = 2.4 tons
- PM reduced per year = 0.07 tons
- Noise pollution reduced 8-15 decibels
- Cost to reduce 1 ton of NOx just \$1,420

EPA Guidance

- Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in SIPs
 - Final – 01/14/04
- Guidance for Quantifying and Using Switch Yard Locomotive Idling Emission Reductions in SIPs
 - Final – 01/14/04
- Guidance for Using Long Duration Truck and Locomotive Idling Emission Reductions for New Source Review Offsets
 - Final – 01/14/04